

ADA130120

12

NPRDC TN 83-8

MAY 1983

**RELATIONSHIPS BETWEEN NUMBER OF ENLISTMENTS
COMPLETED AND IMPORTANCE OF SEPARATION
REASONS: HIERARCHICAL MULTIPLE REGRESSION
APPROACH**

Reproduced From
Best Available Copy

APPROVED FOR PUBLIC RELEASE,
DISTRIBUTION UNLIMITED



DTIC
ELECTE
JUL 7 1983

B

**NAVY PERSONNEL RESEARCH
AND
DEVELOPMENT CENTER
San Diego, California 92152**

20000802021

DTIC FILE COPY



88 07 07 097

**RELATIONSHIPS BETWEEN NUMBER OF ENLISTMENTS COMPLETED AND
IMPORTANCE OF SEPARATION REASONS: HIERARCHICAL
MULTIPLE REGRESSION APPROACH**

**Linda M. Doherty
Michael B. Cowen**

**Reviewed by
Jules I. Borack**

**Released by
James F. Kelly, Jr.
Commanding Officer**

**Navy Personnel Research and Development Center
San Diego, California 92152**

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NPRDC TN 83-8	2. GOVT ACCESSION NO. AD-A130120	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) RELATIONSHIPS BETWEEN NUMBER OF ENLISTMENTS COMPLETED AND IMPORTANCE OF SEPARATION REASONS: HIERARCHICAL MULTIPLE REGRESSION APPROACH		5. TYPE OF REPORT & PERIOD COVERED Final Report FY81-82
		6. PERFORMING ORG. REPORT NUMBER 3-81-3
7. AUTHOR(s) Linda M. Doherty Michael B. Cowen		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Navy Personnel Research and Development Center San Diego, California 92152		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS In-house Independent Research
11. CONTROLLING OFFICE NAME AND ADDRESS Navy Personnel Research and Development Center San Diego, California 92152		12. REPORT DATE May 1983
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		13. NUMBER OF PAGES 25
		15. SECURITY CLASS. (of this report) UNCLASSIFIED
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Personnel turnover Attrition Hierarchical multiple regression (HMR) Enlisted separation questionnaire (ESQ)		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The reasons for separation from the Navy, as identified by responses to the enlisted separation questionnaire (ESQ), were related to Navy tenure. Factor analysis of ESQ responses yielded eight separation reason factors. The number of enlistments completed was found to be inversely related to the importance (in the separation decision) of skill utilization, regimentation, and leadership factors, and directly related to loss of benefits. Hierarchical multiple regression demonstrated differential relationships between mutually exclusive subclasses of individuals for leadership and regimentation.		

DD FORM 1473

EDITION OF 1 NOV 66 IS OBSOLETE
S/N 0102-LF-014-6601

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

FOREWORD

The research was conducted within the in-house independent laboratory research program. The objectives of this effort were to analyze data obtained by the enlisted separation questionnaire using an innovative statistical method, hierarchical multiple regression, to determine if this method would be useful and meaningful for analyzing similar data sets in the future.

JAMES F. KELLY, JR.
Commanding Officer

JAMES W. TWEEDDALE
Technical Director

Accession For	
NTIS GRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A	

SUMMARY

Problem and Background

Retention of qualified petty officers is a problem of considerable magnitude for the Navy. Before policy makers can address this problem, it is important that they understand the reasons why these individuals are leaving the Navy prematurely. One data source being used by the Navy to determine the most important reasons in the separation decision is the enlisted separation questionnaire (ESQ), which is completed by individuals leaving the Navy.

Objective

The objective of this effort was to determine if the hierarchical multiple regression (HMR) method is useful in determining the relationship between the number of completed enlistments and the importance assigned to ESQ separation reasons for individuals and for specific subclasses of individuals.

Approach

1. The sample included 6472 enlisted personnel who completed the ESQ upon discharge from the Navy during FY80.
2. Biodemographic variables obtained from the ESQ were used to classify the sample into mutually exclusive subgroups (e.g., male vs. female, high-school graduate vs. non-high-school graduate, etc.) for use as moderator variables.
3. Because of the many highly correlated ESQ separation reasons (N = 30), factor analysis was performed to create new variables that were composites of these reasons.
4. The relationship (correlation) between the number of completed enlistments and importance of each ESQ factor emerging from the factor analysis was determined.
5. HMR was used to determine the relationship between the number of completed enlistments and each ESQ factor for mutually exclusive subgroups.

Results

1. The separation reason "pay too low" was noted as the most important, followed by "dislike family separation," "too many petty regulations," and "not treated with respect." "Dislike wearing uniform" was the reason rated as least important.
2. Factor analysis of the ESQ separation reasons indicated that they may be represented by eight factors: leadership, skill utilization, quality of benefits, loss of benefits, regimentation, nonpermanent home, amount of work, and pay.
3. The number of enlistments completed was positively related to the importance of loss of benefits, and inversely related to the importance of leadership, skill utilization, and regimentation in the separation decision.
4. Significant relationships were found between the moderators (pay grade, marital status, sea/shore duty, and discharge) and separation factors (skill utilization, non-permanent home, amount of work, quality of benefits, and loss of benefits).

5. HMR demonstrated significant linear moderator effects for pay grade, education, and rating on the relationship between the number of enlistment completions and importance of leadership; and for marital status, pay grade, fleet, and gender on the relationship between the number of enlistment completions and the importance of reenlistment.

Conclusion

Linear HMR is a useful method to determine differential prediction between mutually exclusive subgroups. However, its usefulness is limited when nonlinear regression effects are present.

Recommendations

1. Additional analysis should be conducted on recently obtained ESQ data.
2. HMR should be applied to additional data sets with large heterogeneous samples.
3. HMR should be extended, using a multivariate approach to include multiple independent variables.
4. Where appropriate, HMR should be expanded to include quadratic polynomials to test for curvilinear relationships.

CONTENTS

	Page
INTRODUCTION	1
Problem	1
Background	1
Objective and Hypotheses	1
APPROACH	2
Sample	2
Variables	2
Analysis	4
RESULTS AND DISCUSSION	5
Factor Analysis	5
Relationship Between Independent/Dependent Variables	8
Hierarchical Multiple Regression	9
Moderator Effects on Relationship Between Number of Completed Enlistments Completions and Importance of ESQ Factors	9
Relationship Between Moderators and ESQ Factors	10
Nonlinearity of Regression Effects	12
CONCLUSION	15
RECOMMENDATIONS	15
REFERENCES	17
DISTRIBUTION LIST	19

LIST OF TABLES

	Page
1. Demographic Variables for Sample and U.S. Navy Population (FY 1980)	3
2. Number of Enlistments Completed by Sample Members	4
3. Means and Standard Deviations (SDs) of ESQ Separation Reasons	6
4. Varimax Rotated Factor Analysis Solution: ESQ Separation Reasons	7
5. Pearson Correlations Between Number of Completed Enlistments and ESQ Factors	8
6. HMR on Importance of Leadership Factor with Pay Grade as a Moderator and Number of Completed Enlistments as the Independent Variable	10
7. Relationships Between Moderator Variables and Importance of ESQ Factors	11

LIST OF FIGURES

1. Relationship between number of completed enlistments and importance of ESQ factors	9
2. Moderator effects on relationship between number of completed enlistments and importance of leadership factor	13
3. Moderator effects on relationship between completed enlistments and importance of regimentation factor	14

INTRODUCTION

Problem

The shortfall (approximately 22,000) of qualified petty officers in the Navy has been well documented (NAVPERS, 1980; Sinaiko & Marshall, 1980). Petty officers with 8 to 12 years of technical work experience and training are leaving the service prior to retirement. Before policy makers can address this problem, it is important that they understand the reasons why these individuals are leaving the Navy prematurely. One data source currently being used by the Navy to determine the most important reasons in the separation decision is the enlisted separation questionnaire (ESQ), which is completed by individuals leaving the Navy. The ESQ includes a list of 30 possible reasons for separation (e.g., "pay too low," "dislike sea duty"). Individuals who are voluntarily separating from the Navy are asked to indicate how important each reason was to their separation decision using a 5-point scale where 1 = no importance and 5 = extremely important. Those who are involuntarily separating from the Navy are asked to indicate how important each reason was to their impression of the Navy.

Background

A number of previous studies have identified job-related variables that correlated with the number of completed enlistments. The Center for Naval Analyses (Lockman, Fletcher, Lurie, Marcus, & Thomason, 1981) found that pay and attitudes toward Navy jobs and military life were important to the reenlistment decision. Moreover, job-related factors (e.g., physical work environment, supervision, etc.) were found to be important after completion of the first enlistment, while quality of life factors (e.g., military quarters, family services, etc.) were more important in subsequent completed enlistments. It also has been demonstrated that individual variables are related to reenlistment (for those eligible to reenlist). Education has been found to have a negative relationship (Enns, 1975; Quigley & Wilburn, 1969); and grade or rank, number of dependents, length of first-term enlistment, regions of the country, and per capita income of a state, a positive relationship (Haber & Steward, 1975; LaRocco, Gunderson, & Pugh, 1975; Lindsay & Causey, 1969).

In these studies, Navy tenure has been classified as a dichotomous variable--reenlistment vs. resignation, rather than using the actual number of completed enlistments. Data on attitudes toward separation have been gathered at points in time prior to the date when the separation decision is actually made; on the ESQ, such data are gathered at the time of separation. Also, previous work generally has related a single variable (attitude or biodemographic) to reenlistment, rather than attempting to determine the relationships among biodemographic variables, attitudes, and Navy tenure using multivariate procedures.

Objective and Hypotheses

The objective of this effort was to determine if the hierarchical multiple regression (HMR) method (Cohen & Cohen, 1975) would be useful in determining the relationship between the number of completed enlistments and the importance assigned to ESQ separation reasons for individuals and for specific subgroups of individuals.

It is hypothesized that, as the number of completed enlistments increases, the importance assigned to separation reasons changes and that these changes differ for

mutually exclusive subgroups of individuals (e.g., male vs. female, high-school graduate vs. non-high-school graduate). Conducting simple regression analysis for all individuals who separate is inappropriate because the number of completed enlistments may interact with specific subgroups of individuals. Simple regression results in a correlation that can underestimate the strength of the relationship; thus, in studying the relationship between the importance of separation reasons (dependent variable) and the number of completed enlistments (independent variable), stronger relationships could be identified if the sample were divided into a number of mutually exclusive subgroups. For example, an individual's gender would influence or moderate the relationship between the independent and dependent variables and would be a moderating variable. HMR is an appropriate multivariate technique that determines the independent variable/dependent variable relationship between moderator subgroups; it considers interaction effects by adding the cross product between independent and moderator variables into the regression equation. Each variable (including the interaction) may be entered into the regression analysis in order, with the correlations from all previously entered variables partialled out from each succeeding added variable.

An increase in resulting variance accounted for on the dependent variable (importance of separation reason) may be attributable to the interaction term. The partial linear regression coefficients associated with the interaction term are meaningful and may be tested by an *F* test. For example, if a significant interaction exists, then the relationship between the number of completed enlistments and the separation reason would demonstrate nonparallel slopes for the two mutually exclusive subgroups. Thus, if the sample had been divided into two groups based on gender, the linear regression weights for the number of completed enlistments would be significantly different between the two groups.

HMR has the following advantages:

1. The order of independent variables added into the regression equation may be determined by a priori hypotheses.
2. Patterns of redundancies of independent/dependent variables may be partialled out successively.
3. Statistical tests of partial regression coefficients that account for moderator effects may be conducted.

APPROACH

Sample

The sample included 6472 enlisted personnel who completed the ESQ upon discharge from the Navy in CY80. Table 1, which compares the characteristics of the sample with those of the FY 1980 active-duty Navy population (NAVPERs, 1980) shows that the characteristics of the two groups are highly similar.

Variables

1. Moderator variables. Biodemographic variables from the ESQ were included in the analysis to determine whether they had a moderating effect on the relationship between the number of completed enlistments and the importance of separation reasons.

Table 1
Demographic Variables for Sample and U.S. Navy Population
(FY 1980)

Variable	Sample (N = 6,472) (%)	USN (N = 459,929) (%)
<u>Gender</u>		
Male	96	94
Female	4	6
<u>Branch</u>		
USN	88	89
USNR	12	11
<u>Pay Grade</u>		
E-3 and below	34	37
E-4 and above	66	63
<u>Rating</u>		
Technical ^a	25	23
Nontechnical	75	77
<u>Education</u>		
High-school graduate	86	84
Non-high-school graduate	14	16

^aIncludes DS, EM, EN, ET, EW, FT, HM, HT, IC, MT, and ST ratings.

These moderator variables were divided into mutually exclusive subgroups and classified as either "0" or "1," as shown below:

- a. Pay grade: E-3 and below (0); E-4 and above (1).
- b. Gender: Male (0); female (1).
- c. Branch of service: Regular Navy (0); naval reserves (1).
- d. Marital status: Single (0); married (1).
- e. Education: Non-high-school graduate (0); high-school graduate (1).
- f. Duty: Sea duty (0); shore duty (1).
- g. Fleet: Atlantic (0); Pacific (1).
- h. Discharge: Voluntary (0); involuntary (1).
- i. Rating: Nontechnical (0); technical (1).

2. Independent variable. The independent variable was the number of enlistments completed by sample members, as shown in Table 2. Those who did not respond were eliminated from the regression analysis.

Table 2
Number of Enlistments Completed by Sample Members

Number of Enlistments	Sample Members	
	Number	Percent
None	1305	20.2
1	3314	51.2
2	787	12.2
3 or more	390	6.0
No response	676 ^a	10.4
Total	6472	100.0

^aNot included in the regression analyses, but were included in the factor analysis.

3. Dependent variable. The importance assigned to a separation reason, a continuous variable, was used as the dependent variable. Data on the importance of separation reasons were obtained after an individual had completed service; there was no attempt to predict when an individual would separate from the Navy.

Analysis

1. Factor analysis. Because of the many highly intercorrelated ESQ separation reasons, principal components factor analysis followed by varimax rotation (Nie, Hull, Jenkins, Steinbrenner, & Bent, 1975) was used on the entire sample to create new variables that were composites of these reasons. The number of factors to be retained was determined using the Scree test (Cattell, 1966), and factor scores were created for each subject on each factor.

2. Relationship between dependent/independent variables. The number of completed enlistments and the importance of each separation reason (factor score) were correlated to determine how they related to each other.

3. Hierarchical multiple regression. HMR was used to test the homogeneity of the regression lines between the number of completed enlistments and the importance of ESQ separation reasons. The analysis tested for significant differences between linear regression weights of the moderator subgroups and was performed in the following manner (for each moderator variable):

a. The moderator variable was recoded, with one subgroup equalling "0" and the other, "1."

b. The interaction terms were created by multiplying the moderator variable with the number of completed enlistments (independent variable).

c. Stepwise multiple regression was performed on each of the eight ESQ factors, with the moderator variable being entered into the regression equation first,

followed by the independent variable and the moderator/independent variable interaction term. Multiple correlation coefficients were derived at each step.

d. The amount of variance accounted for by the interaction term beyond that accounted for by the independent and moderator variables (i.e., the variance that was associated with the nonparallelism of the linear regression lines between moderator subgroups) was assessed by the following formula:

$$F = \frac{R^2_{y.A, B, AxB} - R^2_{y.A, B}}{1 - R^2_{y.A, B, AxB}} \cdot \frac{n - K_A - K_B - K_{AxB} - 1}{K_{AxB}}$$

where

y = The ESQ factor score,

A = The moderator,

B = The independent variable,

AxB = The interaction term,

df = $K_{AxB} \cdot N - K_A - K_B - K_{AxB} - 1$,

K_A = The number of moderators,

K_B = The number of independent variables, and

K_{AxB} = The number of interaction terms.

The implication of a significant F is that the regression weight for one moderator subgroup is different from that for the other subgroup for that factor. Graphically, the two regression lines would have different slopes.

RESULTS AND DISCUSSION

Factor Analysis

Table 3, which provides the means and standard deviation (SDs) of the importance assigned the 30 ESQ separation reasons, shows that "pay too low" was rated as most important, followed in order by "dislike family separation" (16), "too many petty regulations" (7), and "not treated with respect" (4). "Dislike wearing uniform" (13) was rated as least important.

Based on results of the Scree Test, the eight factors shown in Table 4 were retained, accounting for about 59 percent of the total variance and using an eigenvalue of .85 as a cutoff. The factor loadings approximate simple structure. Since all but four items (Nos. 7, 22, 25, and 28) loaded more than .50 on only one factor, the solution is statistically reasonable and readily interpretable. The factors are listed below in order of greatest amount of accounted variance.

1. Leadership. Items that loaded (over .50) on this factor (N = 5) were concerned about poor leadership (e.g., "senior officers don't care about enlisted" (3), "not treated with respect" (4), and "poor leadership of my center supervisor" (9)).

2. Skill utilization. Items that loaded on this factor (N = 4) were related to the availability and application of training (e.g., "assigned work doesn't use educational skills" (8) and "can't get rating wanted" (20)).

Table 3

Means and Standard Deviations (SDs) of ESQ Separation Reasons

Separation Reason	Mean ^a	SD
1. Working hours too long	2.70	1.34
2. Fear of losing fringe benefits	2.91	1.42
3. Senior officers don't care about enlisted	3.22	1.38
4. Not treated with respect	3.36	1.39
5. Poor berthing areas afloat	3.20	1.49
6. Poor quality of dental care	2.09	1.34
7. Too many petty regulations	3.48	1.41
8. Assigned work doesn't use educational skills	2.81	1.55
9. Poor leadership of work center supervisor	2.80	1.53
10. Little freedom to use nonwork hours	2.61	1.50
11. Pay too low	4.13	1.23
12. Lack of recognition for doing good job	3.33	1.40
13. Dislike wearing uniform	2.06	1.35
14. Fear of losing retirement benefits	2.27	1.49
15. Want to live someplace permanently	3.31	1.53
16. Dislike family separation	3.56	1.54
17. Can't get education/skills wanted	2.93	1.55
18. Unfair treatment	3.28	1.45
19. Poor quality of commissary/exchange	2.14	1.32
20. Can't get rating wanted	2.11	1.50
21. Poor quality of medical care	2.52	1.48
22. Can't do job in own way	2.54	1.40
23. Dislike sea duty	3.23	1.59
24. Navy housing not available or poor quality	2.50	1.58
25. Can't get desired detailing	2.65	1.53
26. Dislike kind of people work with	2.53	1.47
27. Want ability to quit anytime	2.50	1.52
28. Regulations prevent advancing faster	2.73	1.54
29. Fear of losing GI benefits	2.95	1.62
30. No chance to do interesting/challenging work	3.07	1.49

^aBased on responses to a 5-point scale, where 5 = extremely important and 1 = not true or of no importance.

Table 4

Varimax Rotated Factor Analysis Solution: ESQ Separation Reasons

Reason	Factors							
	Leader- ship 1	Skill Util. 2	Quality of Bene. 3	Loss of Bene. 4	Regimen- tation 5	Nonperm. Home 6	Amount of Work 7	Pay 8
1	.193	.080	.055	.174	.175	.132	.649	.104
2	.118	.029	.144	.815	-.040	.081	.158	.111
3	.735	.067	.132	.078	.035	.053	.185	.155
4	.773	.142	.056	.068	.059	.087	.161	.163
5	.214	.135	.175	.066	.005	.140	.538	.350
6	.117	.174	.562	.142	.126	-.047	.415	-.188
7	.414	.143	-.026	-.050	.338	.049	.177	.480
8	.277	.656	.047	.039	.128	.008	.080	.024
9	.588	.304	.116	.108	.138	.006	.083	-.169
10	.318	.273	.129	.064	.259	.087	.508	-.024
11	.242	.024	.046	.144	-.012	.189	.156	.697
12	.664	.185	.131	.057	.064	.105	.040	.170
13	.083	.103	.234	-.003	.690	.019	.197	-.119
14	-.007	.025	.278	.764	.054	.053	.030	-.140
15	.110	.060	.035	.123	.103	.806	.042	-.013
16	.083	.026	.111	.086	-.032	.823	.028	.087
17	.166	.697	.111	.056	.041	.089	.151	.106
18	.699	.184	.100	-.007	.204	.041	.139	.208
19	.094	.055	.689	.208	.191	-.018	.053	-.007
20	.031	.672	.270	.038	.096	-.015	.173	-.130
21	.192	.133	.661	.087	.085	.043	.244	-.024
22	.447	.383	.214	.064	.358	.101	.054	-.022
23	.031	.076	.078	-.034	.220	.608	.325	.231
24	.078	.116	.655	.131	.081	.233	-.085	.259
25	.179	.348	.492	.164	.035	.188	-.031	.139
26	.420	.132	.153	.056	.518	.067	.016	-.117
27	.115	.124	.037	.019	.747	.145	.113	.182
28	.205	.353	.203	.197	.345	-.002	-.086	.361
29	.099	.195	.086	.730	.053	.086	.068	.165
30	.317	.638	.046	.130	.138	.083	-.017	.216
Eigenvalues	8.23	2.21	1.90	1.46	1.20	1.00	.94	.87
Percent of total vari- ance ac- counted for	46.2	12.5	10.6	8.3	6.7	5.6	5.2	4.9
Cumulative percent	46.2	58.7	69.3	77.6	84.3	89.9	95.1	100.0

3. Quality of benefits. Items that loaded on this factor ($N = 4$) were concerned with the quality of services provided by the Navy (e.g., "poor quality of commissary/exchange" (19) and "poor quality of medical care" (21)).

4. Loss of benefits. Items that loaded on this factor ($N = 3$) were mainly concerned with fear of losing benefits (e.g., "fear of losing fringe benefits" (2) and "fear of losing retirement benefits" (14)).

5. Regimentation. Items that loaded on this factor ($N = 3$) were related to the restrictive nature of military life (e.g., "dislike wearing uniform" (13) and "want ability to quit anytime" (27)).

6. Nonpermanent home. Items loading on this factor ($N = 3$) concerned the separation of families caused by sea duty (e.g., "want to live someplace permanently" (15) and "dislike family separation" (16)).

7. Amount of work. This factor was represented by items ($N = 3$) related to requirements of being available to work at all times (e.g., "working hours too long" (1) and "little freedom to use nonwork hours" (10)).

8. Pay. The only item that loaded on this factor was "pay too low" (11).

Relationship Between Independent/Dependent Variables

Table 5, which presents the Pearson product-moment correlations between the number of completed enlistments and importance of the ESQ factors, shows that the number of completed enlistments was significantly positively related to factors 3, 4, and 6 and significantly inversely related to the others. Although all the correlations were statistically significant, only those associated with leadership, skill utilization, loss of benefits, and regimentation were greater than $r = .1$ in magnitude. Figure 1, which depicts the relationship between the number of completed enlistments and the importance of these four ESQ factors, shows that, as the number of completed enlistments increases, the importance of loss of benefits as a separation reason increases, and the importance of skill utilization, leadership, and regimentation decreases.

Table 5

Pearson Correlations Between Number of Completed Enlistments and ESQ Factors

Factor	r
1. Leadership	-.135*
2. Skill utilization	-.241*
3. Quality of benefits	.070*
4. Loss of benefits	.210*
5. Regimentation	-.160*
6. Nonpermanent home	.067*
7. Amount of work	-.038*
8. Pay	-.035*

* $p < .01$.

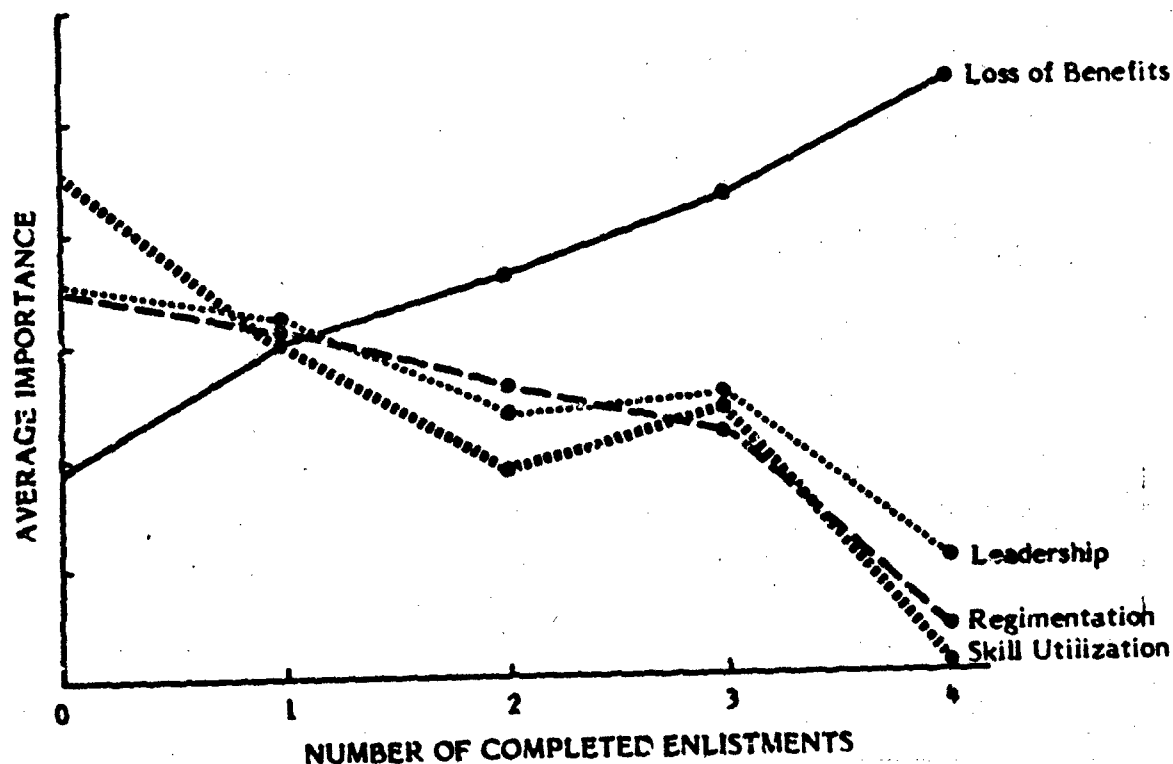


Figure 1. Relationship between number of completed enlistments and importance of ESQ factors.

Hierarchical Multiple Regression

Moderator Effects on Relationship Between Number of Completed Enlistments and Importance of ESQ Factors

A total of 72 HMRs were performed between the nine moderators and the eight ESQ factors. Table 6 provides an example of a step-by-step HMR where pay grade was the moderator and leadership was the dependent variable. As shown, at step 1, pay grade was significantly inversely correlated to the importance of leadership; that is, leadership was less important to the separation decision of individuals at the lower pay grades than to those at the higher pay grades. At step 2, the number of completed enlistments, which was shown to be significantly inversely related to the importance of leadership ($r = -.135$) is added to the regression. At step 3, when the interaction term is added, the percent of variance accounted for in the dependent variable increased significantly. The simple correlation at that step was negative ($r = -.147$), which is indicative of a negative regression weight. The inverse relationship between the number of enlistment completions and the importance of leadership was stronger (more negative) for the higher pay

Table 6

HMR on Importance of Leadership Factor with Pay Grade
as a Moderator and Number of Completed Enlistments
as Independent Variable

Step	Entered Variables	Variables							
		Simple r	Cum R ²	F	df	Added	Inc R ²	F	df
1	X ₁	-.100	.010	57.43*	1,5689	X ₁	.010	57.43*	1,5689
2	X ₁ + X ₂	-.135	.019	55.32*	2,5688	X ₂	.009	52.69*	1,5688
3	X ₁ + X ₂ + X ₃	-.147	.022	42.22*	3,5687	X ₃	.003	15.73*	1,5687

X₁ = Pay grade--moderator variable.

X₂ = Number of completed enlistments--independent variable.

X₃ = Moderator by number of completed enlistments interaction term.

*p < .01.

grades.¹ Thus, this analysis provided information about the direct relationship between the moderator and the dependent variable. Also, the differences for the moderator subgroups on the relationship between the number of completed enlistments and factor importance were determined.

Relationship Between Moderators and Importance of ESQ Factors

Table 7 presents the correlations between the moderator variables and the importance of ESQ factors. The correlations ranged from .070 to .292, and 46 out of 72 were statistically significant. However, most of these were of small magnitude, with only six being above .15. The table shows the following:

1. Pay grade was positively related to importance of loss of benefits and inversely related to importance of skill utilization.
2. Marital status was positively related to importance of quality of benefits and nonpermanent home; those who were married rated these factors higher than did those who were single.
3. A strong relationship was found between sea/shore duty and amount of work, and between type of discharge and skill utilization. Those on sea duty rated the amount of work as more important than did those on shore duty, and those with involuntary

¹The bivariate analysis between pay grade and completed enlistments demonstrated slight heteroscedasticity. The SD for the lower pay-grade group was .59, compared to .89 for the higher pay-grade group.

Table 7

Relationships Between Moderator Variables and Importance of ESQ Factors

Moderators									
Factor	Pay Grade	Gender	Branch	Marital Status	Educational	Fleet	Duty	Discharge	Rating
Simple Correlations Between Moderator Variables and Importance of ESQ Factors									
Leadership	-.100**	-.029	.020	-.101**	-.032**	.044**	-.115**	.050**	-.018
Skill utilization	-.243**	.027	.049**	-.137**	-.065**	.083**	-.067**	.165**	-.098**
Quality of benefits	.033**	.004	-.003	.181**	.016	.119**	.026	.009	.027
Loss of benefits	.159**	-.030*	-.041**	.086**	.051**	-.006	.050**	-.137**	.042**
Regimentation	-.113**	-.041**	.025	-.139**	-.029	.104**	-.071**	.071**	.006
Nonpermanent home	.077**	-.077**	-.017	.292**	-.002	-.083**	-.073**	-.053**	-.005
Amount of work	.023	-.123**	.028	-.134**	-.024	.008	-.231**	-.040	-.054**
Pay	.045**	-.096**	-.028	.012	.109	.034**	-.046**	-.066	.079**
Increase in Percent of Variance Accounted for by the Moderator Interaction Term									
Leadership	-.27**	-.01	.06	-.04	-.10*	-.00	-.01	.06	-.21**
Skill utilization	-.01	.04	.00	.01	.06	.00	.06	-.03	.07
Quality of benefits	.06	-.08	-.01	.01	.03	.00	.00	.03	.01
Loss of benefits	.02	.01	-.03	.01	.00	-.03	.00	.01	-.04
Regimentation	-.31**	.10*	.03	-.09*	-.02	.31**	.00	.00	-.03
Nonpermanent home	.01	.02	-.01	-.03	-.01	.00	.00	-.02	.00
Amount of work	-.30**	.00	.00	-.04	-.04	.00	.00	.07	.00
Pay	-.19**	.00	.00	-.42**	.00	.17**	.02	.02	.00

*p < .025.

**p < .010.

discharges rated skill utilization as more important than did those with voluntary discharges.

The relationship between the number of completed enlistments and the importance of ESQ factors is different for two mutually exclusive moderator subgroups when the percent of variance accounted for in the HMR increases significantly after the interaction term is entered. Table 7 shows the increase in the percent of variance accounted for in the HMR for each moderator by factor, as well as the direction of the simple correlation between the interaction term and the factor. As shown in Table 5, there were four factors--leadership, skill utilization, loss of benefits, and regimentation--whose single-order correlations with number of enlistments completed were greater than .1. However, significant linear moderator effects were found only for the leadership and regimentation factors. These effects are illustrated in Figures 2 and 3 and described below:

1. Leadership. Significant moderator effects were found for pay grade, education, and rating (Figure 2). The inverse relationship between the number of completed enlistments and the importance of leadership was significantly stronger (more negative) for the higher pay grades (compared to the lower pay grades), the high school graduates (compared to nongraduates), and the technical ratings (compared to nontechnical ratings). Leadership became less important as the number of completed enlistments increased, particularly for high-school graduates and technicians.

2. Regimentation. Significant moderator effects (Figure 3) were found for marital status, pay grade, fleet, and gender. The inverse relationship between the number of completed enlistments and the importance of regimentation was significantly stronger (more negative) for higher pay grades (compared to lower pay grades), males (compared to females), those who are married (compared to singles), and those in the Atlantic Fleet (compared to those in the Pacific Fleet). The longer an individual remains in the Navy, the less important regimentation becomes as a separation reason, especially for those in the Atlantic Fleet and high pay grades. For low pay-grade individuals, regimentation remains a consistently important reason over time.

Nonlinearity of Regression Effects

The test for moderator effects is based upon the appropriateness of a linear model, a testable assumption. The individual moderator subgroups found for leadership and regimentation were tested for nonlinearity using trend analysis (Nie et al., 1975). As shown in Figures 2 and 3, several of the moderators did not meet the assumption of linearity. For example, for the leadership factor, the plot of non-high-school graduates is nonlinear, while that for high-school graduates is essentially linear. The usefulness of the linear HMR model is limited when nonlinear effects are present in the data. However, the HMR yielded meaningful and useful results for most moderator subgroups. For example, the plots for high-school graduates and non-high-school graduates for from one to three completed enlistments show definite linear moderator differences. It is possible to test for nonlinear moderator effects by adding second-order power polynomials to the HMR model (Cohen & Cohen, 1975, p. 319). However, the complexity of this model and the number of effects tested would lead to a more complicated interpretation of the results. This present effort was concerned only with the appropriateness of a linear model.

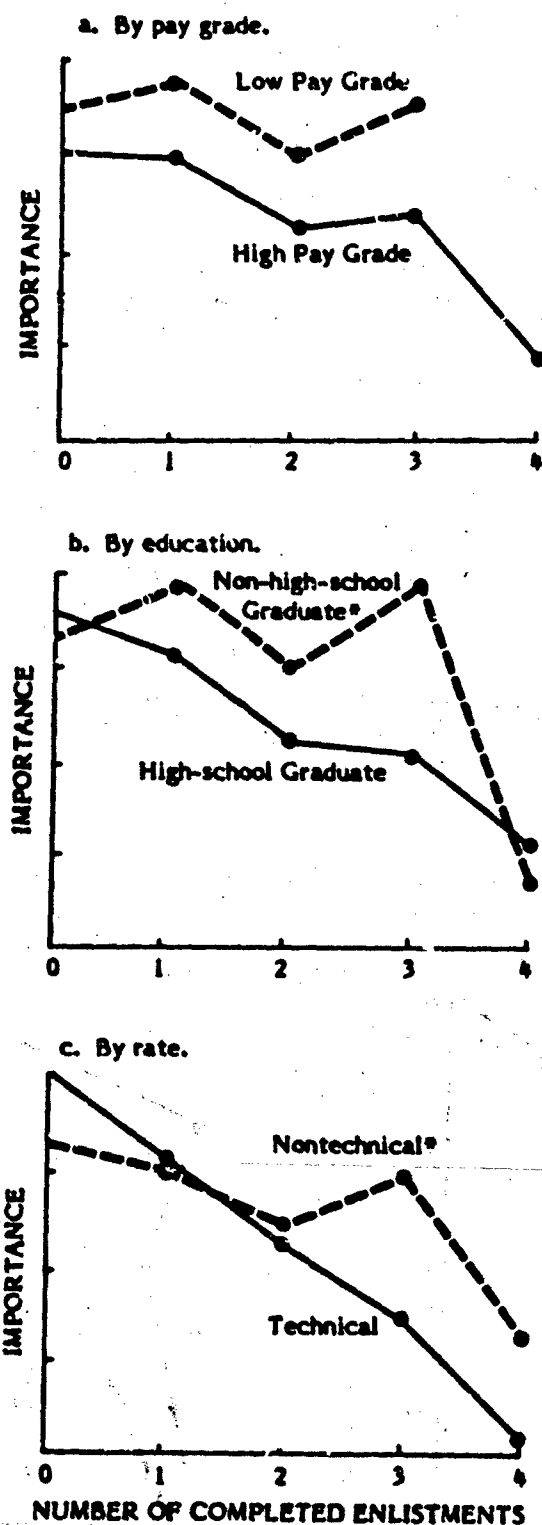


Figure 2. Moderator effects on relationship between number of completed enlistments and importance of leadership factor (*significant nonlinear trend).

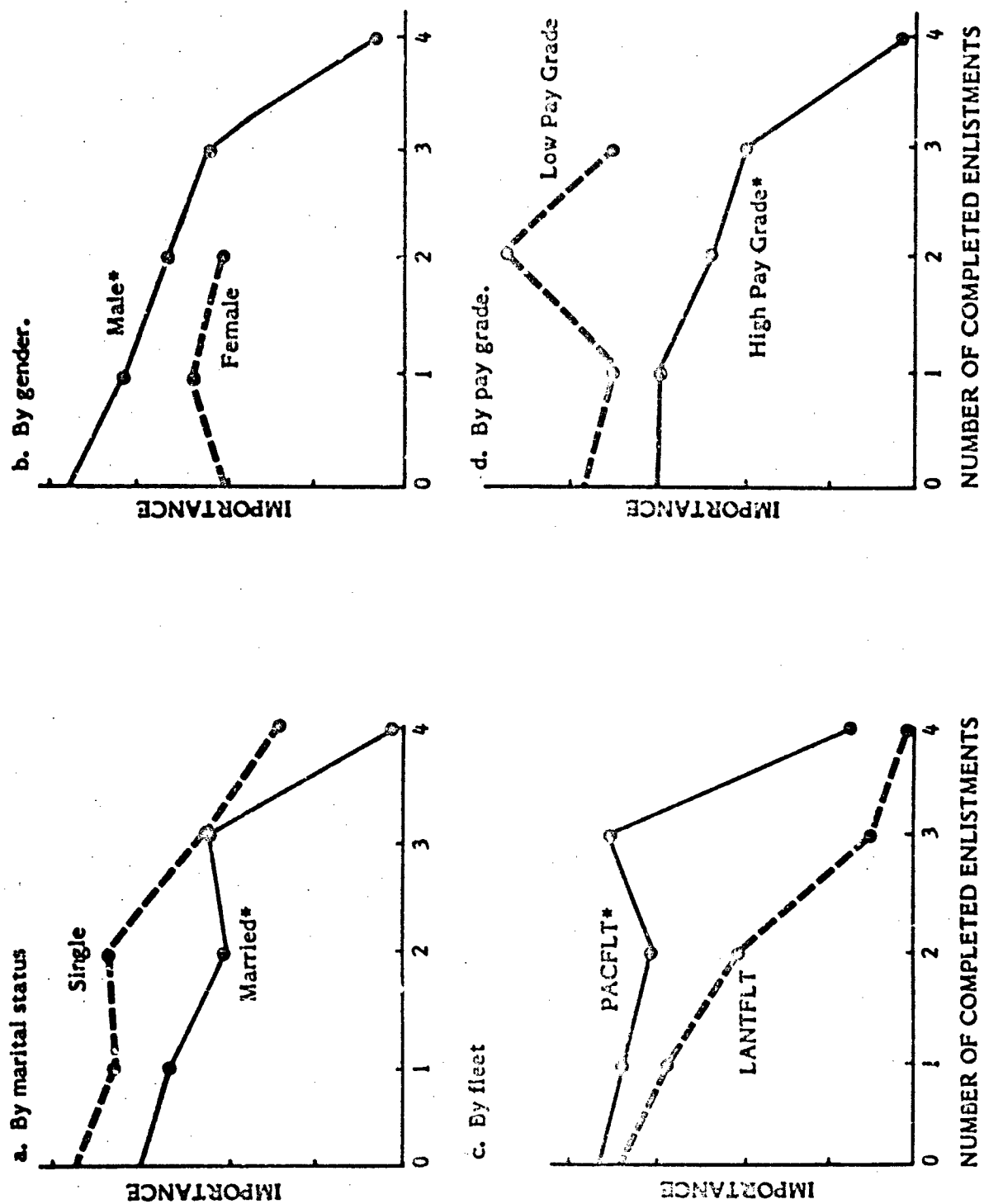


Figure 3. Moderator effects on relationship between completed enlistments and importance of regimentation factor (*significant nonlinear trend).

CONCLUSION

HMR is a useful method to demonstrate differential relationships between two mutually exclusive groups. However, the linear HMR model is limited when nonlinear regression effects are present in the data.

RECOMMENDATIONS

1. Additional analysis should be conducted on more recently obtained ESQ data, as a means of providing reliability to the factor analysis and updated Navy recommendations.
2. HMR should be applied to additional data sets, particularly to questionnaire data on large heterogeneous samples where moderator effects may have significant implications for organizational changes.
3. HMR should be expanded to include multiple independent variables using a multivariate approach in assessing importance of separation factors. One important set would include job characteristics (i.e., skill variety, task meaningfulness, autonomy, and feedback).
4. Where appropriate, HMR should be expanded to include second-order power polynomials to test for curvilinear relationships for moderator subgroups.

REFERENCES

- Bureau of Naval Personnel. Annual Report: Navy military personnel statistics (NAVPERS 15658-A). Washington, DC: Author, September 1980.
- Cattell, R. B. The Scree test for the number of factors. Multivariate Behavioral Research, 1966, 1, 245-275.
- Cohen, J., & Cohen, P. Applied multiple regression/correlational analysis for the behavioral sciences. New York: John Wiley and Sons, 1975.
- Enns, J. N. Effect of the variable reenlistment bonus on reenlistment rates: Empirical results for FY 1971 (TR 1502 ARPA). Santa Monica, CA: The Rand Corporation, June 1975.
- Haber, S. E., & Steward, C. T., Jr. The responsiveness of reenlistment to changes in Navy compensation (TR 1254). Washington, DC: The George Washington University, Graduate School of Arts and Sciences, May 1975.
- LaRocco, J. M., Gunderson, E. K., & Pugh, W. M. Prediction of reenlistment: A discriminant analysis approach (Rep. 75-21). San Diego: Naval Health Research Center, March 1975.
- Lindsay, W. A., Jr., & Causey, B. D. A statistical model for the prediction of reenlistment (RAC-TP 342). McLean, VA: Research Analysis Corporation, March 1969.
- Lockman, R. F., Fletcher, J. W., Lurie, P. M., Marcus, A. J., & Thomason, J. S. Final report of the manpower availability study (CSNE 9). Alexandria, VA: Center for Naval Analyses, September 1981.
- Nie, N., Hull, C. H., Jenkins, J. G., Steinbrenner, K., & Bent, O. Statistical package for the social sciences. New York: McGraw-Hill, 1975.
- Quigley, J. M., & Wilburn, R. C. An economic analysis of first term reenlistment in the Air Force. Washington, DC: Directorate of Personnel Planning (Air Force), September 1969.
- Sinanko, H. W., & Marshall, K. T. How are we going to keep them from going back to the farm? Research on personnel loss in the Navy. U.S. Navy Yearbook of Manpower, Personnel, and Training, 1980, 1, 3-13.

DISTRIBUTION LIST

Chief of Naval Operations (OP-136)
Chief of Naval Material (NMAT 0722)
Chief of Naval Research (Code 200), (Code 440) (3), (Code 442), (Code 442PT)
Commandant of the Marine Corps (MPI-20)
Commander Navy Recruiting Command
Commanding Officer, Office of Naval Research Branch Office, Chicago (Coordinator for Psychological Sciences)
Director, Career Information and Counseling School (Code 3W34)
Superintendent, Naval Postgraduate School
Commander, Army Research Institute for the Behavioral and Social Sciences, Alexandria (PERI-ASL)
Director, Systems Research Laboratory, Army Research Institute for the Behavioral and Social Sciences, Alexandria (PERI-SZ)
Commander, Air Force Human Resources Laboratory, Brooks Air Force Base (Manpower and Personnel Division)
Commander, Air Force Human Resources Laboratory, Wright-Patterson Air Force Base (AFHRL/LR)
Commanding Officer, U.S. Coast Guard Research and Development Center, Avery Point
President, National Defense University (3)
Director, Science and Technology, Library of Congress
Defense Technical Information Center (DDA) (12)